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ABSTRACT

Intended for use by all machine shop instructors in the Metropolitan Nashville Public Schools, this guide provides a sequential listing of course content and scope. A course description provides a brief overview of the content of the courses offered in the machine shop program. General course objectives are then listed. Outlines of the course content are presented for these courses: machine shop I, II, and III. Suggested time and specific objectives are provided for each major topic. Included are safety, hand tools, layout, machine nomenclature, machine operation, bench work, heat treat, drill press, lathe, vertical and horizontal mill, shaper, surface and pedestal grinders, computerized numerical control mills, and blueprint reading. A listing of resource materials, which includes textbooks, curriculum guides, and audio visual materials, is appended. (YLB)

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MACHINE SHOP

SCOPE AND SEQUENCE

VOCATIONAL EDUCATION

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METROPOLITAN NASHVILLE PUBLIC SCHOOLS · EDUCATION FOR FREEDOM ·

Metropolitan Public Schools

Nashville Davidson County, Tennessee

Charles O. Frazier, Director

FOREWORD

This scope and sequence guide, developed for the Machine Shop Vocational Education program, represents an initial step in the development of a systemwide articulated curriculum sequence for all vocational programs within the Metropolitan Nashville Public School System. It is a direct result of needs expressed by teachers, parents, and the business community for sequential structure within the vocational education curriculum. An articulated vocational curriculum allows a student to move from one level of instruction to the next without repeating learning tasks already mastered, and without experiencing gaps in the presentation of relevant instructional material.

A goal of this curriculum effort is to provide teachers a usable guide based on input from the teachers. The initial step was an identification of course content, with all teachers having an opportunity to contribute. What follows is a publication using the teachers' contributions: a sequential listing of objectives and skills for each program offering.

This guide does not include all specific resource materials that may be used to assist students in acquiring minimum competencies. It is to serve as a guide for the sequence of course content and scope of what is to be taught. This guide content is extremely important and its use is encouraged. The suggested competencies and resource materials allow instructors an opportunity to be creative and resourceful in meeting the needs of individual programs and students.

ACKNOWLEDGEMENT

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INTRODUCTION

This guide has been developed to serve as a guide for Machine Shop instructors in the Metropolitan Nashville School System. The material in this guide has been mutually agreed upon by the instructors involved as the material needed to place a student in the field of machine work.

The topics have been arranged to provide for the necessary articulation between programs with flexibility to accommodate the individual differneces within each program.

COURSE DESCRIPTION

This course is designed to give students the basic fundamentals of machine shop work as it applies toward apprenticeship and the knowledge necessary to hold a job in the industry. The machine shop course includes classroom theory and practical application in machine tool operation. Machines on which instruction is given are representative to those found in industry and an industrial atmosphere is simulated as closely as possible.

Included in the study are units or work on safety, hand tools, layout, machine nomenclature, machine operation, bench work, heat treat, drill press, lathe, vertical mill, horizontal mill, shaper, surface grinder, pedestal grinders, computerized numerical control (CNC) mills, and blueprint reading.

Students have an opportunity to participate in VICA leadership training and in local, state and national skills competitions.

GENERAL COURSE OBJECTIVES

1. To teach safety procedures in the machine shop trades
2. To teach proper care and use of tools and equipment used in machine shop occupations
3. To prepare students for successful entry into the machine shop trades
4. To create in students the desire to become highly skilled craftspersons with pride in themselves and their country
5. To teach skills related to the machine trades
6. To help create attitudes of good citizenship and leadership (VICA)
7. To inspire in students, by word and deed, the desire to excel in a chosen field

COURSE CONTENT FOR MACHINE SHOP I

(First Semester)

I. **Orientation (2 weeks)**

Specific objectives:

To become familiar with the local school rules
To become familiar with the general rules pertaining to machine shop

A. Learns general shop rules

B. Learns Vocational Industrial Clubs of America organization

C. Learns attendance and grading standards

II. **Safety (2 weeks)**

Specific objectives:

To identify hazards in the shop
To identify and use safety equipment
To describe safe procedures around the shop and machines

A. Learns general shop rules

B. Takes tour of shop

III. **Basic hand tools (2 weeks)**

Specific objectives:

To identify various types of hand tools
To explain the procedures used for the care and maintenance of basic hand tools

A. Uses non-cutting hand tools

B. Uses cutting hand tools

IV. **Reading shop drawings (2 weeks)**

Specific objective:

To become familiar with isometric drawings

IV. **Reading shop drawings continued:**

A. Learns to identify symbols and terminology

B. Learns to read and interpret a typical working drawing

V. **Layout (2 weeks)**

Specific objectives:

To prepare the workpiece for layout
To measure and scribe layout lines on the workpiece

A. Uses layout tools (semi-precision and precision measurement)

B. Develops layout work

VI. **Horizontal power saws (2 weeks)**

Specific objectives:

To identify the various types of power saws
To learn to set up and operate power saws

A. Learns to use cut off machines (saws)

B. Practices safety procedures

C. Operates machines

VII. **Vertical power saws (3 weeks)**

Specific objectives:

To identify the various types of power saws
To learn to set up and operate power saws

A. Learns to use vertical band machines (saws)

B. Practices safety procedures

C. Learns to weld band saw blades

D. Operates machines

VIII. **Drill Press (3 weeks)**

VIII. Drill Press continued:

Specific objectives:

To become familiar with various types of drilling machines
To learn to set up and operate drilling machines (basic operations)

A. Learns history of drilling machines

B. Practices safety

C. Practices drilling machine operation

D. Uses drilling tools

E. Uses work locating and holding devices

F. Develops skills in operating drilling machine

COURSE CONTENT FOR MACHINE SHOP I

(Second Semester)

I. Lathe basic (12 weeks)

Specific objectives:

To identify the parts of a lathe and their function
To set up and operate lathe (basic operations)

A. Explores history of lathes

B. Learns safety procedures

C. Learns general lathe information (part of the lathe)

D. Learns methods of maintenance and adjustment of lathes

E. Uses toolholders and toolholding devices

F. Uses cutting tools on lathes

G. Practices the operation of the machine lathe

H. Completes facing and center drilling processes

I. Turns on the lathe (semi-precision measuring instruments)

J. Files and polishes work on the lathe

K. Completes knurling operations

L. Completes taper turning with taper attachment

M. Completes taper turning with compound rest

N. Practices drilling operations

O. Completes cut off or parting tool operations

P. Completes precision turning operation (precision measuring instruments)

Q. Completes thread turning operations

I. **Lathe basic continued:**

R. Continues advanced project assignment in machine area

II. **Bridgeport mill (6 weeks)**

Specific objectives:

To identify a variety of different milling machine attachments and tools
To set up and operate bridgeport vertical milling machine (basic operation)

A. Explores the history of milling machines

B. Learns safety procedures

C. Uses various cutting tools

D. Sets up machine for work

E. Practices drilling, counterboring

COURSE CONTENT FOR MACHINE SHOP II

(First Semester)

I. **Orientation (1 week)**

Specific objectives:

To review local school rules
To review general rules pertaining to machine shop

A. Reviews shop policies and rules

B. Participates in Vocational Industrial Clubs of America activities

II. **Safety (1 week)**

Specific objectives:

To review safety in the shop
To review safety equipment and shop hazards

A. Reviews safety rules and equipment

B. Reviews shop hazards

III. **Lathe advanced (6 weeks)**

Specific objectives:

To set up and operate the lathe (advanced machining operations)
To work with advanced tooling materials

A. Uses work holding devices

B. Practices drilling and reaming

C. Practices boring

D. Completes threading operations

E. Completes taper turning and taper boring

F. Uses steady rest and follow rest

G. Uses carbide and other tooling materials

IV. Advanced drill press (4 weeks)

Specific objectives:

To set up and operate drill press and radial arm drill press (advanced operations)
To learn to sharpen drill bits

A. Sharpens drill bits

B. Operates drill press and radial arm drill press

V. Advanced vertical mill (6 weeks)

Specific objectives:

To set up and operate the vertical milling machine (advanced operations)
To identify and work with advanced tools and fixtures

A. Reviews safety procedures

B. Checks operation of machine

C. Selects proper cutting tools

D. Sets up machine for required operations

E. Completes operation using end mill

F. Completes operation using the offset boring head

COURSE CONTENT FOR MACHINE SHOP II

(Second Semester)

I. **Horizontal mill (6 weeks)**

Specific objectives:

To set up and operate horizontal milling machines
To identify a variety of different horizontal milling machine attachments
To set up and cut a spur gear

A. Reviews history of mills

B. Reviews safety procedures

C. Uses plain and universal mills

D. Studies and uses various types of spindles, arbors and adaptors

E. Uses arbor-driven cutters

F. Selects proper speed and feeds for various metals

G. Works with various holding devices

H. Practices with indexing devices

I. Studies gears and ratios

J. Completes cutting a spur gear

II. **Shaper (2 weeks)**

Specific objectives:

To set up and operate a shaper
To identify tooling used on a shaper

A. Reviews and studies features and tooling of shapers

B. Analyzes cutting factors

C. Uses safety procedures

D. Completes operations assigned

III. **Grinding machines (6 weeks)**

Specific objectives:

To identify various types of grinding machines
To set up and operate a surface grinder

A. Reviews and studies history and types of grinding machines

B. Uses grinding machine safety

C. Works with holding devices

D. Completes operations assigned

IV. **Physical properties and the heat treating of metals (4 weeks)**

Specific objectives:

To learn the different elements and alloys
To operate the heat treat oven and harden various steels

A. Studies machanical and physical properties of metals

B. Performs heat treating of metals

COURSE CONTENT FOR MACHINE SHOP III

(First and Second Semesters)

I. **Numerical control programming (18 weeks)**

Specific objectives:

To become more proficient in all areas covered in Machine Shop II
To develop entry level job skills

A. Reviews history and orientation

B. Uses safety precautions

C. Studies manual numerical control programming

D. Studies computer numerical control and computer numerical control machining

II. **Electro-machining processes (9 weeks)**

Specific objectives:

To become more proficient in all areas covered in Machine Shop II
To develop entry level job skills

A. Studies history and orientation of electro-machining

B. Uses safety practices

C. Studies electrical discharge machining

III. **Tool and cutter grinding (9 weeks)**

Specific objectives:

To become more proficient in all areas covered in Machine Shop II
To develop entry level job skills

A. Studies history and orientation

B. Practices safety precautions

C. Uses grinding wheels

III. **Tool and cutter grinding continued:**

D. Selects and uses grinders to sharpen cutters

E. Selects and uses grinders to sharpen end mills

RESOURCE MATERIALS

Textbooks

White, Neely, Kibbe and Meyer. Machine Tools and Machining Practices, Volume I & II. New York: John Wiley & Sons, 1977.

Walker, John. Machining Fundamentals. South Holland, Illinois: Goodheart-Willcox Company;, 1977.

Curriculum Guides

Machine Tool Technology. Repp/McCarthy, Bloomington, Illinois: McKnight Publishing Company, 1979.

Audio Visual

Filmstrips

(Bergwell Productions, Inc., Garden City, New York, 1980)

#501 - Lathe - 5 strips per set used in Dukane (20 min. each)

#502 - Mill - 5 strips per set used in Dukane (20 min. each)

#503 - Measuring Tools - 5 strips per set used in Dukane (20 min. each)

#504 - Metal Shop Safety - 5 strips per set used in Dukane (20 min. each)